

## CLAIMS

1 1. A process for fabricating a heat sink, comprising:

2 providing a heat sink; and

3 treating the heat sink to a cryogenic quenching process.

SP 1 2. The process of Claim 1 wherein the heat sink is fabricated from a metal alloy  
OF 2 having precipitating constituents.

BT 1 3. The process of Claim 1 wherein the heat sink is part of a microelectronic package  
CP 2 including a die affixed to a carrier substrate.

D 1 4. The process of Claim 1 further comprising prior to treating the heat sink to the  
H 2 cryogenic quenching process first treating the heat sink to a temperature high enough to  
C 3 lead to a secondary re-crystallization grain growth, which changes the microstructure of  
E 4 the heat sink from a fine grain to a coarse grain

1 5. The process of Claim 1 wherein the treating of the heat sink to the cryogenic  
2 quenching process includes gradually lowering the heat sink to a cryogenic temperature  
3 and then immediately raising the temperature of the heat sink.

1 6. The process of Claim 4 wherein the changing of the microstructure of the heat  
2 sink from a fine grain to a coarse grain improves the thermal conductivity of the heat sink

3 by reducing the number of grain boundaries in the heat sink that obstruct the movement  
4 of atomic and molecular species.

1 7. The process of Claim 1 further comprising affixing the heat sink to a  
2 microelectronic die mounted to a package substrate.

1 8. A process of fabricating a heat sink, comprising:  
2 providing a heat sink comprised of a metal alloy;  
3 raising the temperature of the heat sink to cause a secondary re-crystallization  
4 grain growth in the metal alloy; and  
5 treating the heat sink to a cryogenic quenching process.

1 9. The process of Claim 8 wherein the metal alloy has precipitating constituents.

1 10. The process of Claim 8 wherein the thermal conductivity of the heat sink is  
2 improved by changing the microstructure of the metal alloy from a fine grain structure to  
3 a coarse grain structure.

1 11. The process of Claim 8 wherein the heat sink is fabricated from an aluminum  
2 alloy.

1 12. The process of Claim 8 wherein the heat sink is fabricated from a copper alloy.

1       13. The process of Claim 8 further comprising affixing the heat sink to a  
2       microelectronic die mounted to a package substrate.

1       14. A process of fabricating a heat sink, comprising:  
2              providing a heat sink; and  
3              expanding the grain structure in the heat sink from a fine grain to a coarse grain to  
4       enhance the thermal conductivity of the heat sink.

1       15. The process of Claim 14 wherein the heat sink is fabricated from a metal alloy  
2       with secondary re-crystallization grain growth.

1       16. The process of Claim 15 further comprising treating the heat sink to a cryogenic  
2       quenching process by gradually lowering the heat sink to a cryogenic temperature and  
3       then immediately raising the temperature.

1       17. The process of Claim 14 wherein the heat sink is part of a microelectronic  
2       package which includes a die affixed to a package substrate, the thermal conductivity of  
3       the heat sink improved by reducing the grain boundaries that obstruct the movement of  
4       atomic and molecular species.